We Claim:

1. A microdischarge device, comprising:

a first layer having a tapered cavity disposed therein;

an intermediate layer on the first layer; and

a second layer on the intermediate layer, the intermediate layer electrically insulating the first layer from the second layer, the first and second layers having a conductivity larger than that of the intermediate layer.

2. The microdischarge device of claim 1, wherein the cavity has an inverted square pyramidal shape.

3. The microdischarge device of claim 1, wherein the first layer is a semiconductor.

4. The microdischarge device of claim 3, wherein the first layer comprises Si.

5. The microdischarge device of claim 3, wherein the first layer, the intermediate layer and the second layer form a diode, and the intermediate layer is a depletion region of the diode.

6. The microdischarge device of claim 1, wherein the intermediate layer comprises at least one dielectric layer.

7. The microdischarge device of claim 5, wherein an angle of taper of the cavity is at least 20 degrees and at most 45 degrees.

8. The microdischarge device of claim 5, wherein an area of the cavity at a surface of the first layer is not greater than 100 μm square.

9. The microdischarge device of claim 5, wherein a depth of the tapered cavity in the first layer is not greater than 100 μm.

10. The microdischarge device of claim 5, wherein the first layer comprises Si.

11. The microdischarge device of claim 5, wherein the lifetime of the device is at least 10 hours.

12. The microdischarge device of claim 6, wherein an angle of taper of the cavity is at least 20 degrees and at most 45 degrees.

13. The microdischarge device of claim 6, wherein an area of the cavity at a surface of the first layer is not greater than 100 μm square.

14. The microdischarge device of claim 6, wherein a depth of the tapered cavity in the first layer is not greater than 100 μm.

15. The microdischarge device of claim 6, wherein the first layer comprises Si.

16. The microdischarge device of claim 6, wherein the lifetime of the device is at least 10 hours.

17. The microdischarge device of claim 6, wherein the intermediate layer comprises a plurality of dielectric layers, at least two of the plurality of dielectric layers having different dielectric constants.

18. The microdischarge device of claim 1, wherein the cavity extends through at least a surface of the second layer.

19. The microdischarge device of claim 1, wherein side walls of the cavity are coated with a film that reflects light.

20. The microdischarge device of claim 1, further comprising a gas disposed in the cavity.

21. The microdischarge device of claim 1, wherein the second layer comprises an electrically conducting screen disposed on an end of the cavity.

22. The microdischarge device of claim 21, wherein the screen serves as a cathode of the microdischarge device.

23. The microdischarge device of claim 1, further comprising an optically transmissive material that seals the cavity.

24. The microdischarge device of claim 1, wherein the first layer serves as a cathode of the microdischarge device.

25. An array comprising a plurality of microdischarge devices according to claim 1.

26. The array of microdischarge devices of claim 15, wherein the array is divided into independently excited sub-arrays.

27. A lighting array comprising the array of microdischarge devices according to claim 15.

28. A laser comprising a plurality of the microdischarge devices according to claim 1.

29. A microdischarge device, comprising:

a semiconductor layer having a tapered cavity disposed therein;

an intermediate layer on the semiconductor layer; and

a second layer on the intermediate layer, the intermediate layer electrically insulating the semiconductor layer from the second layer.

30. The microdischarge device of claim 19, wherein the semiconductor layer comprises Si.

31. The microdischarge device of claim 19, wherein the semiconductor layer, the intermediate layer and the second layer form a diode and the intermediate layer is a depletion region of the diode.

32. The microdischarge device of claim 19, wherein the second layer is a metal.

33. The microdischarge device of claim 31, wherein an angle of taper of the cavity is at least 20 degrees and at most 45 degrees.

34. The microdischarge device of claim 31, wherein an area of the cavity at a surface of the semiconductor layer is not greater than 100 μm square.

35. The microdischarge device of claim 31, wherein a depth of the non-cylindrical cavity in the semiconductor layer is not greater than 100 μm.

36. The microdischarge device of claim 31, wherein the semiconductor layer comprises Si.

37. The microdischarge device of claim 31, wherein the lifetime of the device is at least 10 hours.

38. The microdischarge device of claim 32, wherein an angle of taper of the cavity is at least 20 degrees and at most 45 degrees.

39. The microdischarge device of claim 32, wherein an area of the cavity at a surface of the semiconductor layer is not greater than 100 μm square.

40. The microdischarge device of claim 32, wherein a depth of the non-cylindrical cavity in the semiconductor layer is not greater than 100 μm.

41. The microdischarge device of claim 32, wherein the semiconductor layer comprises Si.

42. The microdischarge device of claim 32, wherein the lifetime of the device is at least 10 hours.

43. The microdischarge device of claim 29, wherein the intermediate layer comprises at least one dielectric layer having a lower electrical conductivity than the semiconductor and second layers.

44. The microdischarge device of claim 43, wherein the intermediate layer comprises a plurality of dielectric layers, at least two of the plurality of dielectric layers having different dielectric constants.

45. The microdischarge device of claim 29, wherein the cavity extends through at least a surface of the second layer.

46. The microdischarge device of claim 29, wherein side walls of the cavity are coated with a film that reflects light.

47. The microdischarge device of claim 29, further comprising a gas disposed in the cavity.

48. The microdischarge device of claim 29, wherein the second layer comprises an electrically conducting screen disposed on an end of the cavity.

49. The microdischarge device of claim 48, wherein the screen serves as a cathode of the microdischarge device.

50. The microdischarge device of claim 29, further comprising an optically transmissive material that seals the cavity.

51. The microdischarge device of claim 29, wherein the semiconductor layer serves as a cathode of the microdischarge device.

52. An array comprising a plurality of microdischarge devices according to claim 29.

53. The array of microdischarge devices of claim 52, wherein the array is divided into independently excited sub-arrays.

54. A lighting array comprising the array of microdischarge devices according to claim 32.

55. A laser comprising a plurality of the microdischarge devices according to claim 29.

56. A method of fabricating a microdischarge device comprising: forming a tapered cavity in semiconductor material, and forming a microdischarge device comprising the semiconductor material.

57. The method of claim 56, wherein forming the cavity in the semiconductor material comprises a step of forming the cavity in the semiconductor material.

58. The method of claim 56, further comprising forming the cavity in the semiconductor material by wet etching the semiconductor material.

59. The method of claim 56, further comprising filling the cavity with a gas.

60. The method of claim 56, further comprising forming the cavity by etching an n-type semiconductor material, etching a p-type semiconductor material and etching a depletion region formed by the n-type and p-type semiconductor material.

61. The method of claim 56, further comprising forming the cavity by etching the semiconductor material and a metal.

62. The method of claim 56, further comprising etching the semiconductor material to form the cavity and subsequently depositing a metal layer on the semiconductor material.

63. The method of claim 62, further comprising forming an intermediate layer on the semiconductor material.

64. The method of claim 63, further comprising forming the intermediate layer by depositing a single dielectric layer on the semiconductor material.

65. The method of claim 63, further comprising forming the intermediate layer by depositing at least two dielectric layers of different dielectric constants on the semiconductor material.

66. The method of claim 63, further comprising etching through the intermediate layer prior to depositing the metal layer.

67. The method of claim 63, further comprising etching through the intermediate layer after depositing the metal layer.

68. The method of claim 56, further comprising affixing a conducting screen to an end of the cavity.

69. The method of claim 56, further comprising sealing the cavity with an optically transmissive material.

70. The method of claim 56, further comprising establishing the semiconductor material as a cathode of the microdischarge device.

71. The method of claim 56, wherein the semiconductor material comprises silicon.

72. The method of claim 56, further comprising arranging a plurality of the devices in an array.

73. The method of claim 56, further comprising dividing the array into independently excited sub-arrays.

74. The method of claim 56, further comprising coating side walls of the cavity with at least one film that reflects light.